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METHOD OF OPERATION
TEST CIRCUIT

Final Multiple Test Lines, for testing incoming selector circuits having Four Party Semi Selector A.C. Ringing - 95-110 volts - automatic Routine Selector Test Frame - Power Division Mechanical Switching.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

This circuit is used for testing machine switching incoming selector circuit. These incoming circuits are equipped with four party semi-selective ringing feature and have 24 volts talking battery.

2. WORKING LIMITS

This circuit is used only when the voltage of the exchange battery is 24 to 25 volts for 24 volt battery and 48.5 to 50 volts for 48 volt battery.

OPERATION

3. PRINCIPAL FUNCTIONS

The principal functions of this circuit are as follows:

3.1 To test the ringing relays in the incoming selector circuit for (a) premature tripping, (b) proper tripping and (c) non-tripping.

3.2 To give the supervisory relay in the circuit under test a soaking current, and then a releasing current, after which the relay continues to be operated and released alternately until disconnection takes place.

4. CONNECTING CIRCUITS

These test lines are assigned special numbers and are cross connected to the final multiple but are not connected to either line finders. Test calls are made by either a routine testing circuit or the manual testing circuit at the originating end, which selects a trunk for test and stop only when trouble is found or a busy trunk is encountered.

DETAILED DESCRIPTION

5. When the test number designated by the Telephone Company, is sent either by an automatic test circuit, or by a machine switching B operator, who sets up the number on the keyboard as a regular call, an incoming

selector seizes a final selector, which in turn hunts for the first idle test line. When this circuit is seized by the final selector, battery over the S lead operates the (C.) relay which locks to battery on the S lead when the test switch (R-1) advances to position 2. The (CO) relay operated, at this time performs no useful function. When the incoming selector circuit under test has advanced to its ringing position, the (R) relay operates on the first period of ringing current supplied by a two ring interrupter. The operation of the (R) relay closes a circuit from ground through to battery through the winding of the (R-1) relay, which operated. The operation of the (R-1) relay closes circuit (A) from ground through the PU interrupter brush 1 (not shown) (PU-1) lamp, cam (I), the (R-1) relay operated, cam E, the (PU-1) and PU-2) relays, to battery through the winding of the (PU-2) relay, and (B) from ground through the PU interrupter brush 2 (not shown), PU-2 lamp, cam H, the (R-1) relay, operates the (PU-2) and (PU-1) relays normal to battery through the winding of the (PU-1) relay. When the ringing current operating the (R) relay is being received through ringing brush set 1 from the incoming circuit, (PU-1) relay operates, and locks through its make contact to ground on cam D. When the ringing current is being supplied to the test circuit through ringing brush set 2, the (PU-1) relay operates and locks through to ground on cam D. The operation of either the (PU-1) or (PU-2) relays, opens the operating circuit to the other relay, preventing its operation. The operation of either the (PU-1) or (PU-2) relays closes a circuit from ground cam B, to battery through the R-1 magnet, advancing the switch to position 2. Should either set of interrupter brushes connect ground through the make or break contact of the (PU-1) relay before ringing current is disconnected and with the R-1 switch in position 2, the (PU) relay operates on its inner winding and locks on its outer winding to ground on cam C, preventing further operation of the test circuit until disconnection takes place. With the switch in position 2, ringing current is disconnected from the test circuit in the interval between the first and second rings, releasing the (R) relay, which in turn releases the (R-1) relay. The release of the (R-1) relay closes a circuit from ground on cam D, through the (CO) relay operated the (R-1) relay normal, cam F, the (PU) relay normal to battery through the R-1 magnet, advancing the switch to position 3. When the next interval of two ring ringing current is applied to the test circuit, the (R) relay reoperates, in turn operating the (R-1) relay. The operation of the (R-1) relay connects ground through cam D, the (CO) and (R-1) relays operated cam E, the (PU) relay normal, to battery through the R-2 magnet, advancing the switch to position 4. In position 4, either the PU interrupter brush set 1, or brush set 2 supplies ground through cams I and H respectively, and contacts of the (PU-1) relay, to battery through the (PU) relay, operating the relay. The operation of the (PU) relay, closes a circuit from ground on cam D, through the (CO) relay operated the (R-1) relay normal, which released during the interval between rings, cam F,

the (PU) relay operated to battery through the R-1 magnet, advancing the switch to position 5. As the switch leaves position 4, the (PU) relay releases.

PREMATURE TRIPPING TEST

6. With the R-1 switch in position 5, a circuit is closed from either ringing interrupter brush set 1, or brush set 2, through either the make or break contact depending upon the position of the (PU-2) relay, contacts of cam O.S M.F. condenser, (R) relay to generator ground on cam N, operating the (R) relay on the first ringing period of the two ring current. Ringing current is also being supplied from the incoming under test but this current performs no useful functions in the test circuit. The (R) relay operated, in turn operates the (R-1) relay, which closes a circuit from ground on cam D, through the (CO) and (R-1) relays operated, cam E (R-1), cam B on R-2, to battery through the R-2 magnet, advancing the timing switch from position 1 the A cam carrying it to position 9. As the R-2 switch is advancing through position 2 to 7-3/4, the T and R sides of the test line are closed through cam E on R-2, cam L on R-1, D, C, and B resistances for 1/2 second, testing for premature tripping of the ringing relay in the incoming selector circuit under test. At the end of the first ringing period, the (R) and (R-1) relays release, closing a circuit from ground on cam D, through the (CO) relay, operated the (R-1) relay normal, cams F and G, cam B on R-2, to battery through the R-2 magnet, advancing the switch to position 10. With the R-1 switch in position 5, and the R-2 switch in position 10, the (R) and (R-1) relays reoperate on a second period of ringing current, closing a circuit from ground through the operated relay cam E on R-1, cam G and R-2, to the R-2 magnet, advancing the switch out of position 10, the A cam carrying it to position 18.

7. As the R-2 switch is moving through position 11 to 16-3/4, the ringing relays in the incoming selector circuit under test, are again tested for premature tripping, by connecting the B, C and D, resistances across the tip and ring sides of the test line through cams L and E. When the (R) relay releases at the end of the second ringing period the (R-1) relay releases, and closes a circuit from ground through cams F and G on R-1, cam C on R-2, which is in position 18, to battery through the R-1 magnet, advancing the switch to position 18. The R-2 switch is advanced to position 1 from ground, (R-1) relay normal, cam F and G in position 5, to battery through cam B. When the (R) relay operates on the first period of the next ringing interval, the (R-1) relay operates, and closes a circuit through cam E on R-1, cam B on R-2, to battery through the R-2 magnet, advancing the timing switch out of position 1, the A cam carrying it to position 9. As the R-2 switch is passing through position 2 to 7 1/4 on its second revolution, the premature tripping of the ringing relays is tested a third time. In the silent period between the two rings, the (R) relay releases, in turn releasing the (R-1) relay, which connects ground through cams F and G, cam G, to battery through the R-2 magnet, advancing the timing switch to position 10. With the R-2 switch in position 10,

the same ground through cam C on R-2 advances the R-1 switch to position 7. In position 7 of R-1, the (R) relay is connected across the T and R sides of the test circuit awaiting the second interval of ring curent.

TRIPPING TEST

8. If the ringing relays in the incoming selector circuit under test have not tripped prematurely, and the (R) relay operates on the second ringing interval, in turn operating the (R-1) relay, which closes a circuit from ground through cam E, the (PU) relay normal to battery through the R-1 magnet, advancing the switch to position 8. However, should the ringing relays in the incoming selector circuit trip prematurely, the (R) relay does not operate, and the test circuit is held up until cleared from the originating end. In position 8 of R-1, the silent interval between two rings occurs, releasing the R relay, which in turn releases the (R-1) relay. The release of the (R-1) relay closes ground through cam F, to battery through the R-1 magnet, advancing the sequence switch to position 9. In position 9 of R-1, the (R) relay is connected in a circuit from generator ground on cam N, winding of the (R) relay, cam O, contact of the (PU-2) relay to either brush set 1, or brush set 2, of the ringing interrupter, operating the (R) relay. The (R) relay reoperates the (R-1) relay, which connects ground through cam E to cam G on R-2, advancing the R-2 switch out of position 10 of its second revolution. The R-2 switch is carried to position 18, by means of the A cam, and as it passes through position 11 to 16-3/4 the ringing relays in the test selector circuit are tested for timing tripping, by connecting the (B) resistance and the 530 ohm portion of the C resistance across the T and R side of the test line. During the silent period, after the second two ring interval, the (R) and (R-1) relays release which advances the (R-2) switch to position 1, in a circuit through cams F and G, and cam B on R-2. With the R-2 switch in position 1, the same ground through the (R-1) relay normal cams F and G on R-1, cam C on R-2, to battery through the R-1 magnet, advances the testing switch to position 10.

9. With the switch in position 10, the R relay is again connected across the tip and ring sides of the test line, awaiting the next internal of ringing current. If the ringing relays in the selector circuit under test have not tripped, the R and R-1 relays operate on the first period of ringing current, and the R-1 relay locks through cam J, and the CO relay operated to ground on cam D, preventing further operation of the testing circuit until disconnection takes place. If the ringing relays in the incoming circuits are tripped, ringing current is not supplied to the test circuit, and the R and R-1 relays consequently do not operate. During the ringing interval, with the testing switch in position 10, ground is supplied either through pick up interrupter brush set 1, or brush set 2, cam I or cam H, make or break contact of the PU-1 relay, depending upon whether the PU-2 or PU-1 relay is operated, to battery through the inner winding of the PU relay, which operates. With the PU relay operated, and the R-1 relay non-

operated, a circuit is closed from ground on cam D, through the CO relay, operated, the R-1 relay normal, cam F, the PU relay operated to battery through the R-1 magnet, advancing the switch to position 11. As the test switch leaves position 10, the holding circuits for the PU-1, or PU-2 relays, and the PU relay are open, releasing the relay. In position 11 of the R-1 switch, the R-1 relay is placed under control of the 149 interrupter. When the contacts of the interrupter make, a circuit is closed from ground on cam K, through the interrupter, cam J, to battery through the winding of the R-1 relay, which operated. The operation of the R-1 relay closes a circuit from ground on cam D, through the CO and R-1 relays operated, the PU relay normal to battery through the R-1 magnet advancing the switch to position 12. With the switch to position 12, the R-1 relay releases when the interrupter contacts break, and advances the testing switch to position 13, in a circuit from ground on cam D, through the CO relay operates the R-1 relay normal cam F to battery through the R-1 magnet, the testing switch remains in position 13, approximately 1/2 second until the brushes on the 149 interrupter make. During the tip and ring sides of the test line, through cam M, to give a soaking current to the supervisory relay under test in the incoming selector circuit.

SUPERVISORY RELAY TEST

10. When the contacts of the 149 interrupter make the R-1 relay reoperates, and closes a circuit from ground cam E, the PU relay normal, to battery through the R-1 magnet, advancing the testing switch to position 14. When it leaves position 13, the short around the winding of the LO relay is open at cam M, allowing the LO relay to operate over the tip and ring side of the test line, in series with the testing resistances, and the CS relay in the incoming, to battery and ground in the incoming selector circuit under test. The operation of the LO relay connects ground through cam O, to battery through the outer winding of the PU relay, which locks through its make contact to the same ground. In position 14 of the R-1 switch, the contacts of the 149 - interrupter make, operating the R-1 relay, which prevents the moving of the R-1 switch out of position 14, through the break contact of the R-1 relay. During the interval that the brush of the 149 interrupter makes the B, C, D, F, G, and H resistances and the winding of the LO relay, are connected across the tip and ring side of the test line to release the supervisory relay in the incoming selector circuit. Upon the break of the interrupter brushes, the R-1 relay releases, connecting ground through its break contact and cam F, to battery through the R-1 magnet, advancing the testing switch to position 15. In position 15 of the switch, the B and C, or the B, C and 120 ohm portion of the D resistance, depending upon the length of subscriber's loop over which the supervisory relay is adjusted to operate are connected across the tip and ring sides of the test circuit through the contacts of the 149 interrupter cam J, and the winding of the LO relay. As the contacts of the 149 interrupter alternately make and break the supervisory relay in the incoming selector circuit under test, is alternately operated and released

until the required number of pulses is sent back to satisfy the routine test circuit (not shown).

DISCONNECTION

11. When the routine test circuit is satisfied disconnection takes place, opening the tip and ring sides of the test circuit in the incoming selector circuit, releasing the LO relay. When the final selector circuit releases the S terminal of the test circuit, the CO relay releases, closing a circuit from battery through the "A" resistance, the CO relay normal, cam P, to the S terminal, holding this circuit busy to other hunting finals until restored to normal. The release of the CO relay also closes a circuit from ground on cam D to battery through the winding of the MR register, which operates and records the number of test made with this circuit. The operation of the MR register closes a circuit from ground cam D on R-3 to battery through the R-2 magnet, advancing the switch to normal. With the R-2 switch in position 1, the same ground is connected through cam D or R-2, cam B on R-1 to battery through the R-1 magnet advancing the test switch to position 1. In position 1 of R-1, the MR register releases, restoring the circuit to normal.

12. In case of premature disconnection due to fault in either the incoming circuit itself, the test line circuit awaits in the position in which the trouble occurred until the release of the S terminal by the final. From this point the circuit is restored to normal as described above.

ENG. I.M.W.
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CHK'D BY J.I.

APPROVED H.L. MOYNES.
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CIRCUIT REQUIREMENTS

THE READJUST REQUIREMENTS SHOWN BELOW ARE FOR MAINTENANCE USE ONLY.

	OPERATE	NON-OPERATE	RELEASE
B263 (LO)	Special requirements to insure fast release. Readj. .0033 amp. Test .0035 amp. W.C.C. .0055 amp.		Readj. .0008 amp. Test .0007 amp.
E1726 (PU)	Test requirement of outer winding is proportional to test requirement of inner winding.		
Inner Wdg. (1500 ohms)	Readj. .019 amp. Test .020 amp. W.C.C. .021 amp.	Readj. .012 amp. Test .011 amp.	
Outer Wdg. (1500 ohms)	Test .023 amp. W.C.C. .028 amp.		
E1730 (CO)	Test requirement of inner winding is proportional to test requirement of windings in series.		
Wdg. series aiding	Readj. .018 amp. Test .033 amp. W.C.C. .048 amp.	Readj. .012 amp. Test .011 amp.	
Inner Wdg. (100 ohms)	Test .088 amp. W.C.C. .134 amp.		
E1734 (PU-1 and PU-2)	Readj. .020 amp. Test .022 amp. W.C.C. .024 amp.		Readj. .003 amp. Test .0028 amp.

NOTE: To prevent chattering, the "make-before-break" spring combination of this relay shall be so adjusted that the spring, which normally makes on the back contact, will give the greatest possible contact pressure against the back contact.

CIRCUIT REQUIREMENTS

THE READJUST REQUIREMENTS SHOWN BELOW ARE FOR MAINTENANCE USE ONLY.

	OPERATE	NON-OPERATE	RELEASE
E1765 (R-1)	Special requirements to insure A.C. control. Readj. .012 amp. Test .013 amp. W.C.C. .021 amp.	Readj. .0075 amp. Test .0071 amp.	
J6 (RT)	Special requirements to insure A.C. operation		

MECHANICAL REQUIREMENTS

(a) Air gap shall be .023" minimum.
(b) Contact follow shall be .003" minimum.
(c) Armature tension shall be 5 grams minimum

ELECTRICAL REQUIREMENTS

	Test by connecting a series non-inductive resistance of 7300 ohms between the ringing bus bar and the I.M.F. condenser and J6 relay in series.		Open circuit
5C Message Register	Test 20 volts	Test 18.5 volts	

ENG.--TML-BH.
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CHK'D.--CHW-CWP.

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